(19) The Japanese Patent Office
(12) Laid-Open Patent Application Publication (A)
(11) Laid-Open Patent Application Publication No. P2000-217199
(43) Publication Date: August 4, 2000 (2000.8.4)
(51)

Int. Cl.[7]	Classification Symbol	FI		
H04S 7/00		H04S 7/00	Z	5D020
G10H 1/46		G10H 1/46		5D062
H03G 7/00		H03G 7/00	Z	5D378
H04R 3/00	310	H04R 3/00	310	5J022
H03M 1/00		H03M 1/00		5J030

Request for Examination: not yet requested
Number of Claims: 3 OL (17 pages in total)

(21) Application No. Patent Application No. Hei11-16601
(22) Application Date: January 26, 1999 (1999.1.26)

(71) Applicant: 000116068
Roland K.K.
No. 4-16, Dojimahama 1-chome, Kita-ku, Osaka-shi, Osaka-fu, Japan
(72) Inventor: Hiroshi AKAMATSU
c/o Roland K.K.,
No. 4-16, Dojimahama 1-chome, Kita-ku, Osaka-shi, Osaka-fu, Japan
(72) Inventor: Akira MATSUI
c/o Roland K.K.,
No. 4-16, Dojimahama 1-chome, Kita-ku, Osaka-shi, Osaka-fu, Japan
(72) Inventor: Yoshiya KUMAI
c/o Roland K.K.,
No. 4-16, Dojimahama 1-chome, Kita-ku, Osaka-shi, Osaka-fu, Japan
(74) Agent: 100087000
Patent Attorney, Junichi UEJIMA

F-Term
5D020 AC01
5D062 CC01 CC02
5D378 HA01 QQ01 QQ31 QQ34 SD04
TT19 XX15 XX25 XX32
5J022 AA01 AB01 CA02 CC01
5J030 BA09 BB02 BC00

(54) Title of the Invention: VOICE CONTROL DEVICE, VOICE PROCESSING DEVICE, AND MIXING SYSTEM

(54) Abstract
[Problem to be Solved] To make it unnecessary to provide a separate unit for mixing and branching transmission paths when a mixing system is constituted by interconnecting more than two in total number of voice control devices and voice processing devices including at least one each of the voice control device and the voice processing device.
[Solution] A system comprises: a control signal input means for entering a control signal, a control signal output means for outputting control signals, a voice level control information generation means for generating voice level control information, a voice level control information output means for attaching discrimination information to the voice level control information and outputting the information as control signals, a processing means for carrying out a process according to the entered control signal when it is determined that the discrimination information indicates that the device itself is the subject of control, and a control signal transfer means for outputting inputted control signal when it is determined that the discrimination information does not indicate that the means itself is to stop outputting the control signal.

[Claims]

[Claim 1] A voice control device for use in a mixing system in which more than two in a total number of voice control devices having an operation member for instructing control of voice levels of voice signals; and voice processing devices constituted physically separate from the voice control devices may be connected in a loop and placed in separate places in isolation, the voice processing device mix-processing and outputting voice signals of a plural number of channels inputted from outside according to the instruction of control of the voice level by the operation member of the voice control device,

the voice control device comprising:

a control signal input means for entering control signals from an external device;

a control signal output means for outputting control signals to an external device;

a voice level control information generation means for generating voice level control information for controlling the voice level of the voice signal according to the operation of the operation member;

a voice level control information output means for attaching discrimination information, indicating the device to be controlled by the voice level control information and the device for stopping output of control signals, to the voice level information outputted from the voice level control information generation means and for outputting that information as a control signal through the control signal output means to an external device;

a processing means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the subject of control and, in case the discrimination information indicates that the means itself is the subject of control, carrying out a process according to the entered control signal; and

a control signal transfer means for determining whether or

not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the device for stopping output of the control signal and, in case it is determined that the discrimination information does not indicate that the means itself is the device for stopping output of the control signal, outputting the entered control signal to an external device through the control signal output means.

[Claim 2] A voice control device for use in a mixing system in which more than two in a total number of voice control devices having an operation member for instructing control of voice levels of voice signals; and voice processing devices constituted physically separate from the voice control devices may be connected in a loop and placed in separate places in isolation, the voice processing device mix-processing and outputting voice signals of a plural number of channels inputted from outside according to the instruction of control of the voice level by the operation member of the voice control device,

the voice control device comprising:

a control signal input means for inputting control signals from an external device;

a control signal output means for outputting control signals to an external device;

a voice level information generation means for generating voice level information indicating voice levels;

a voice level information output means for attaching discrimination information, indicating the device of output origin of the voice level information and the device for stopping output of control signals, to the voice level information outputted from the voice level information generation means and for outputting that information as a control signal through the control signal output means to an external device;

a processing means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself

is the subject of control and, in case the discrimination information indicates that the means itself is the subject of control, carrying out a process according to the entered control signal; and

a control signal transfer means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the device for stopping output of the control signal and, in case it is determined that the discrimination information does not indicate that the means itself is the device for stopping output of the control signal, outputting the entered control signal to an external device through the control signal output means.

[Claim 3] A mixing system constituted by interconnecting, in a loop, more than two in a total number of the voice control device according to Claim 1 and the voice processing device according to Claim 2.

[Detailed Description of the Invention]

[0001]

[Technical Field]

This invention relates to a voice control device, voice processing device, and a mixing system. More specifically, this invention relates to a voice control device for instructing control of voice signals, voice processing device for mix-processing voice signals according to control instruction by the voice control device, and a mixing system constituted by interconnecting the voice control device and the voice processing device through transmission paths and placing them in separate places in isolation.

[0002]

[Prior Art]

A mixing system is conventionally known, that receives voice signals of a plural number of channels as inputs, controls the input voice signals of a plural number of channels according

to the voice level set for every channel, carries out mix-processing, and outputs the voice signals.

[0003]

Such a conventional mixing system is generally constituted by physically making a single unit with a voice control section for controlling the voice levels of the voice signals and a voice processing section for mix-processing the voice signals according to the voice levels controlled with the voice control section.

[0004]

When the conventional mixing system, constituted with the voice control section and the voice processing section physically made into a single unit, is to be used in a concert site or the like, it is a common practice to place the system backward in the concert site so that it does not obstruct the performance carried out on the stage, forward in the concert site and that the user can directly confirm the mixing effect.

[0005]

Therefore, to connect resources (instruments) such as microphones and electric guitars present forward in the concert site to the mixing system present backward in the concert site, a number of cables corresponding to the number of the resources must be laid to extend from the stage present forward in the concert site to the mixing system placed backward in the concert site. The complicated work of laying the cables has been a problem.

[0006]

On the other hand, a mixing system has been proposed as the one capable of alleviating the cable-laying work, constituted with a voice control device for controlling voice signals and a voice processing device for mix-processing voice signals according to the control by the voice control device, with both devices electrically interconnected through a transmission path.

[0007]

In other words, since this mixing system is constituted by interconnecting through the transmission path the voice control device and the voice processing device formed as physically separate bodies, it is possible to put the voice control device

and the voice processing device in separate places in isolation.

[0008]

Therefore, such a conventional mixing system constituted with physically separate voice control device and voice processing device, making it possible to put both of the devices in separate places, is the one that can be used by putting the voice processing device, to be connected to the cable from the resources such as microphone and electric guitar, in the vicinity of the stage forward in the concert site, while putting the voice control device backward in the concert site, and interconnecting the voice processing device and voice control device through a single cable.

[0009]

Therefore, the above-described conventional mixing system constituted with physically separate voice control device and voice processing device, unlike the conventional mixing system with voice control section and voice processing section made into a single unit, has been the one that does not require a number of cables, corresponding to the number of resources such as microphone and guitar, to be extended from the stage, present forward in the concert site, to the backward part in the concert site.

[0010]

Incidentally, when the above former of the conventional mixing system with voice control section and voice processing section made into a single unit is used, there are cases in which a plural number of systems are connected and used for the purpose of increasing the number of input channels or for the purpose of controlling the voice signal level not only backward in the concert site but also in the vicinity of a performer such as the stage wings.

[0011]

However, with the above latter of the conventional mixing system constituted with physically separate voice control device and voice processing device, such a connection has not been in consideration.

[0012]

If connection is intended with the latter of the conventional mixing system, the number of the voice control device or the voice processing device becomes two or more, resulting in the constitution of a mixing system with a total number of three or more of the devices. In that case, it is thought that mixers are required for mixing signals passing through transmission paths interconnecting the devices and branching device for branching signals passing through transmission paths interconnecting the devices, inviting problems of complicated constitution and increased costs.

[0013]

[Problem to be Solved by the Invention]

This invention has been made in view of the problems associated with the prior art as described above. The object of the invention is to provide a voice control device, a voice processing device, and a mixing system adapted that, when the voice control devices and the voice processing devices, at least one each, three or more in a total number, are connected to be used as a mixing system, without requiring a separate unit for mixing or branching transmission paths interconnecting the devices so as not to invite complicated constitution and increased costs.

[0014]

[Means for Solving the Problem]

To accomplish the above object, a voice control device according to Claim 1 of the invention is adapted to be used in a mixing system in which more than two in a total number of voice control devices having an operation member for instructing control of voice levels of voice signals; and voice processing devices constituted physically separate from the voice control devices may be connected in a loop and placed in separate places in isolation, the voice processing device mix-processing and outputting voice signals of a plural number of channels inputted from outside according to the instruction of control of the voice level by the operation member of the voice control device, the

voice control device comprising: a control signal input means for entering control signals from an external device; a control signal output means for outputting control signals to an external device; a voice level control information generation means for generating voice level control information for controlling the voice level of the voice signal according to the operation of the operation member; a voice level control information output means for attaching discrimination information, indicating the device to be controlled by the voice level control information and the device for stopping output of control signals, to the voice level information outputted from the voice level control information generation means and for outputting that information as a control signal through the control signal output means to an external device; a processing means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the subject of control and, in case the discrimination information indicates that the means itself is the subject of control, carrying out a process according to the entered control signal; and a control signal transfer means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the device for stopping output of the control signal and, in case it is determined that the discrimination information does not indicate that the means itself is the device for stopping output of the control signal, outputting the entered control signal to an external device through the control signal output means.

[0015]

A voice processing device according to Claim 2 of the invention is usable in a mixing system in which more than two in a total number of voice control devices having an operation member for instructing control of voice levels of voice signals; and voice processing devices constituted physically separate from the voice control devices may be connected in a loop and placed in separate places in isolation, the voice processing device

mix-processing and outputting voice signals of a plural number of channels inputted from outside according to the instruction of control of the voice level by the operation member of the voice control device, the voice control device comprising: a control signal input means for inputting control signals from an external device; a control signal output means for outputting control signals to an external device; a voice level information generation means for generating voice level information indicating voice levels; a voice level information output means for attaching discrimination information, indicating the device of output origin of the voice level information and the device for stopping output of control signals, to the voice level information outputted from the voice level information generation means and for outputting that information as a control signal through the control signal output means to an external device; a processing means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the subject of control and, in case the discrimination information indicates that the means itself is the subject of control, carrying out a process according to the entered control signal; and a control signal transfer means for determining whether or not the discrimination information attached to the control signal entered to the control signal input means indicates that the means itself is the device for stopping output of the control signal and, in case it is determined that the discrimination information does not indicate that the means itself is the device for stopping output of the control signal, outputting the entered control signal to an external device through the control signal output means.

[0016]

A mixing system according to Claim 3 of the invention is constituted by interconnecting in a loop more than two in total number of the voice control device according to Claim 1 and the voice processing device according to Claim 2.

[0017]

[Embodiments]

An embodiment of the voice control device, voice processing device, and mixing system according to the invention is described in detail below in reference to appended drawings.

[0018]

Fig. 1 is a block diagram, showing a hardware constitution of a mixing system having a voice control device and a voice processing device according to the present invention.

[0019]

Incidentally, Fig. 1 shows one mixing system using one voice control device and one voice processing device that are interconnected in one-to-one relationship to facilitate understanding.

[0020]

As shown in Fig. 1, a mixing system 10 is constituted with a voice control device (hereinafter called "console") 12 controlled by a microcomputer (not shown) for controlling voice signals, and a voice processing device (hereinafter called "processor") 14 controlled by a microcomputer (not shown) for mix-processing voice signals according to the control by the console 12. The console 12 and the processor 14 are formed as physically separate units so that they can be placed in separate places in isolation.

[0021]

Specifically for example, the console 12 is placed backward in the concert site and the processor 14 is placed near the stage present forward in the concert site.

[0022]

Here, an input level detecting section 46 (to be described later) of the processor 14 and a voice signal processing section 48 (to be described later) of the processor 14 are embodied with digital signal processors (DSPs).

[0023]

Here, the console 12 and the processor 14 are electrically interconnected through a transmission path 16 for inputting signals (digital control signal and digital voice signal, to be

described later) outputted from the console 12 into the processor 14 and through a transmission path 18 for inputting signals (digital control signal and digital voice signal, to be described later) outputted from the processor 14 into the console 12, so that both the digital control signals and digital voice signals may be communicated bi-directionally.

[0024]

Each of the transmission path 16 and the transmission path 18 is made of a single cable. These cables of this embodiment use XLR connectors of AES-EBU specification.

[0025]

The console 12 is constituted with: a remote fader 20 for producing and outputting analog voice level control signals for controlling voice levels of voice signals of respective channels corresponding to the positions of fader operation members 20-1 to 20-4 (set, in this embodiment, for four channels corresponding to the number of channels of microphones 42-1 to 42-4) as resources placed on the stage or the like located forward in the concert site; an analog-to-digital (A-D) converter 22 for converting analog voice level control signals outputted from the remote fader 20 into digital voice level control signals and outputting them; an A-D converter 26 for converting analog voice signals inputted from an outside microphone (MIC) 24 and a CD player (not shown) into digital voice signals and outputting them; a multiplexing section 28 for multiplexing and outputting the digital voice level control signals outputted from the A-D converter 22 and the digital voice signals outputted from the A-D converter 26 to the transmission path 16; a separating section 30 for separating and outputting digital control signals and digital voice signals after these signals are inputted through the transmission path 18; and a digital-to-analog (D-A) converter 32 for converting the digital voice signals separated and outputted from the separating section 30 into analog voice signals and outputting the analog voice signals.

[0026]

Incidentally, the microphone 24 and the CD player may be

built within the voice control section.

[0027]

It is preferable to provide an operation member to be operated by a user to turn on and off the input of analog voice signals of the microphone 24 and the CD player to the A-D converter 26.

[0028]

Further, it is adapted that the analog voice signals outputted from the D-A converter 32 may be given to the external headphone 34 or the like to be monitored by the user.

[0029]

It is also adapted that the digital input level information signal in the digital control signal separated with and outputted from the separating section 30 is outputted to the outside headphone 34 or the like to be monitored by the user.

[0030]

On the other hand, the processor 14 is constituted with: a separating section 40 serving also as an input means for separating multiplexed digital control signals and digital voice signals after they are inputted through the transmission path 16 and outputting the separated signals; an A-D converter 44 for converting analog voice signals inputted through four channels of outside microphones (MIC) 42-1 to 42-4 placed as resources on a stage of a concert site or the like into digital voice signals and outputting them; an input level detecting section 46 made of a DSP for outputting digital voice signals outputted from the A-D converter 44 and for detecting the input level information of the digital voice signals and outputting the signals as digital input level information signal or digital control signals; a voice signal processing section 48 made of a DSP for mix-processing according to the voice level control signals and digital voice signals in the digital control signals separated with and outputted from the separating section 40 and for outputting digital voice signals; a D-A converter 50 for converting digital voice signals outputted from the voice signal processing section 48 into analog voice signals and outputting them; and a

multiplexing section 52 serving also as an outputting means for multiplexing digital input level information signal or digital control signal outputted from the input level detecting section 46 and digital voice signals outputted from the voice signal processing section 48 and outputting them to the transfer passage 18.

[0031]

The analog voice signals outputted from the D-A converter 50 are outputted to the outside speaker 54 (made up of a speaker 54L for the left channel of a stereo and a speaker 54R for the right channel of the stereo) so that audible musical sound is released in the air.

[0032]

Fig. 2 shows a data division format of AES-EBU specification used in this embodiment. The multiplexing section 28 of the console 12 and the multiplexing section 52 of the processor 14 respectively multiplex the digital control signals and the digital voice signals according to the format shown in Fig. 2 and output signals to the transmission path 16 and the transmission path 18, respectively. In other words, the same data format is used in both directions of the bidirectional communication between the console 12 and the processor 14. As a result, the transmission path 16 and the transmission path 18 of the same constitution may be used.

[0033]

In Fig. 2, A0, B0, ... denote sub-frames (with "A" denoting the left channel (L. ch) of the stereo, and "B" the right channel (R. ch) of the stereo) with each sub-frame made up of 32 bits.

[0034]

Of these 32 bits, bit 0 to bit 3 form a preamble, bit 4 to bit 7 are auxiliary data, bit 8 to bit 27 are audio data of the left or right channel corresponding to the digital voice signals, bit 28 is a parity bit, bit 29 is a user data, bit 30 is a channel status data denoting the channel of the digital voice signal, and bit 31 denotes validity.

[0035]

In this embodiment, data for one sample of the left or the right channel are transferred for every sub-frame of the digital sound signals, and one word of the digital control signal is constituted with the user data of the bit 29 of the 16 sub-frames.

[0036]

One digital control signal is made up of a plural number of words. These words includes, for example, a word showing what the digital control signal is related to, and a word showing a level value.

[0037]

For example, a digital control signal as a voice level control signal outputted from the console 12 contains a word indicating in what number-th channel the digital control signal is to control the level of the voice signal, and a word indicating to what level the voice signal in that channel is to be controlled.

[0038]

Further, a digital control signal as input level information outputted from the processor 14 contains a word indicating for what number-th channel the digital control signal indicates the level of the voice signal, and a word indicating what is the level of the voice signal in that channel.

[0039]

In other words, in this embodiment, since the existing format of AES-EBU specification is used as described above in the multiplexing section 28 of the console 12 and in the multiplexing section 52 of the processor 14, existing cables using XLR connectors may be used as the transmission path 16 and the transmission path 18.

[0040]

The console 12 of the above constitution produces analog voice level control signals, corresponding to positions of the fader operation members 20-1 to 20-4 corresponding to respective channels of the remote fader 20, for controlling voice levels of respective channels. The analog voice level control signals are outputted to the A-D converter 22.

[0041]

The A-D converter 22 receives analog voice level control signals outputted from the remote fader 20, converts the analog voice level control signals into digital voice level control signals as digital control signals, and outputs them to the multiplexing section 28.

[0042]

The A-D converter 22 digitizes the outputs of the four remote faders 20 by time division. The multiplexing section 28 monitors the control level indicated with the digital voice level control signal of each channel, and outputs, when a change occurs in the control level in any channel, a digital voice level control signal as a digital control signal.

[0043]

On the other hand, analog voice signals inputted from the microphone 24 are converted with the A-D converter 26 into digital voice signals and outputted to the multiplexing section 28.

[0044]

The digital voice signals outputted from the A-D converter 22 are made time-division multiplex stereo signals for two channels. The voice signals inputted through the microphone 24 are evenly distributed to left and right channels.

[0045]

The multiplexing section 28 receives digital voice level control signals as digital control signals outputted from the A-D converter 22 and digital voice signals outputted from the A-D converter 26, multiplexes the digital control signals and the digital voice signals according to the data division format of the AES-EBU specification shown in Fig. 2, and outputs the results to the transmission path 16 made of a single cable using XLR connectors.

[0046]

In the processor 14, multiplexed digital control signals and digital voice signals inputted through the transmission path 16 are first inputted to the separating section 40. The separating section 40 separates the multiplexed digital control signals and digital voice signals into digital control signals

and digital voice signals, and outputs them to the voice signal processing section 48.

[0047]

On the other hand, analog voice signals inputted through the microphones 42-1 to 42-4 are converted into digital voice signals with the A-D converter 44 and, after the input level information being detected with the input level detecting section 46, outputted to the voice signal processing section 48.

[0048]

Here, the voice signal processing section 48 receives digital voice level control signals for four channels in the digital control signals outputted from the separating section 40, receives digital voice signals outputted from the input level detecting section 46, controls the voice level of the digital voice signals with the digital voice level control signals for four channels in the digital voice level control signals outputted from the separating section 40, receives digital voice signals outputted from the separating section 40, applies mixing process to these digital voice signals, and outputs them as stereo digital voice signals of left and right channels to the D-A converter 50 and to the multiplexing section 52.

[0049]

The voice signal processing section 48 stores the control level when the digital voice level control signals are supplied from the console 12. The processing section 48 then carries out mixing process according to the stored control level.

[0050]

The D-A converter 50 receives stereo digital voice signals of left and right channels inputted from the voice signal processing section 48, converts the stereo digital voice signals of left and right channels into stereo analog voice signals of left and right channels, outputs analog voice signals of the left channel to the left channel-use speaker 54L while outputting analog voice signals of the right channel to the right channel-use speaker 54R.

[0051]

In this way, the analog voice signals inputted through the microphones 42-1 to 42-4 into the processor 14 are mix-processed by the voice level controlled with the remote fader 20 of the voice signal control section 12 to produce musical sound through the left speaker 54L and the right speaker 54R connected to the processor 14. The audible musical sound is released in the air.

[0052]

In this way, the analog voice signals inputted through the microphone 24 to the console 12 cause audible musical sound to be released in the air from the left channel-use speaker 54L and the right channel-use speaker 54R that are connected to the processor 14.

[0053]

Therefore, the mixing system 10 described above performs the same mixing process as with the conventional mixing system described in the section "Prior Art" when no analog voice signals are inputted from the microphone 24 to the console 12.

[0054]

On the other hand, when analog voice signals are inputted through the microphone 24 to the console 12 in the above mixing system 10, a user present in a position, for example backward in the concert site, where the console 12 connected to the microphone 24 is placed, can give various instructions from the speaker 54 through the microphone 24 to the performer on the stage located forward in the concert site.

[0055]

Further, in case a CD player in place of the microphone 24 is connected, it is possible to play background music in the concert site.

[0056]

Incidentally, the digital input level information signal as digital control signal outputted from the input level detecting section 46 and the digital voice signal outputted from the voice signal processing section 48 are outputted to the multiplexing section 52.

[0057]

The multiplexing section 52, receiving digital input level information signals outputted from the input level detecting section 46 and digital voice signals outputted from the voice signal processing section 48, performs multiplexing with the digital input level information signals (or digital control signals) and the digital voice signals, and outputs the results to the transmission path 18 which is a single cable using XLR connectors of the AES-EBU specification.

[0058]

The input level detecting section 46 detects input levels of four channels by time division. The multiplexing section 52 monitors input levels indicated with the digital input level information signals of respective channels and, in case of change in the input level, outputs the digital input level information signal of the channel, in which the change has occurred in the input level, as a digital control signal.

[0059]

In the console 12, the digital input level information signals and digital voice signals, inputted through the transmission path 18 and multiplexed, are then first inputted to the separating section 30, where they are separated into the digital input level information signals and digital voice signals. The digital input level information signals are outputted to external level meters 36, and the digital voice signals are outputted to the D-A converter 32.

[0060]

Therefore, the user can monitor the input levels of voice signals of respective channels by not only relying on the musical sound sent out in the concert site but also watching the external level meters 36.

[0061]

The D-A converter 32 converts the digital voice signals separated with and outputted from the separating section 30 into analog voice signals, and outputs them to the headphone 34.

[0062]

Therefore, the above mixing system 10 makes it possible for

the user present in the place where the console 12 connected to the headphone 34, for example backward in the concert site, to directly monitor the manner of voice input to the microphones 42-1 to 42-4 by the performer on the stage located forward in the concert site.

[0063]

As described above, the console 12 and the processor 14 constituting the mixing system are interconnected through the two lines, the transmission path 16 and the transmission path 18, to use one exclusively for transmission (output) and the other exclusively for reception (input), and to transmit and receive (output and input) digital control signals and digital voice signals.

[0064]

In specific terms, the console 12 uses the transmission path 16 exclusively for transmission (output) and uses the transmission path 18 exclusively for reception (input), while the processor 14 uses the transmission path 18 exclusively for transmission (output) and uses the transmission path 16 exclusively for reception (input).

[0065]

Here, the transmission path 16 and the transmission path 18 are the same in constitution as described above.

[0066]

Therefore, to constitute a mixing system including at least one each of the console 12 and the processor 14, in a total number of more than two of the console 12 and the processor 14, the console 12 and the processor 14 are interconnected through the transmission paths 16 (since the transmission paths 16 and 18 are the same in constitution as described above, the former is used also for the latter) in a loop, so that the upstream-located console 12 or processor 14 and the downstream-located console 12 or processor 14 are different from each other, and the consoles 12 and the processors 14 are provided with a function of supplying digital control signal supplied from upstream-located console 12 and processor 14 to downstream-located console 12 and processor

14. In this way, it is possible to control any console 12 and processor 14 from any console 12 and processor 14 without providing a separate unit for mixing or branching the transmission paths.

[0067]

Here, "interconnecting the console 12 and the processor 14 in a loop" means "interconnect them in a loop so that each of the console 12 and the processor 14 has a dedicated transmission (output) path 16 for transmitting (outputting) signals (digital control signals and digital voice signals) to downstream console 12 or processor 14 and a dedicated reception (input) path 16 for receiving (inputting) signals (digital control signals and digital voice signals) from upstream console 12 or processor 14."

[0068]

As described above, the mixing system is constituted by interconnecting in a loop the console 12 and the processor 14 through the transmission paths 16 to include at least one each of the console 12 and the processor 14, in a total number of more than two of the console 12 and the processor 14, without requiring a separate unit for mixing or branching the transmission paths and without complicating the constitution or increasing costs.

[0069]

Here, methods of interconnecting in a loop the console 12 and the processor 14, more than two in total, including at least one each, through the transmission paths 16 to constitute a mixing system include for example the ones shown in Figs. 3(a), 3(b), and 3(c).

[0070]

That is, according to the connection method shown in Fig. 3(a), a first console 12 is connected, through the transmission path 16, to a second console 12 located downstream thereof, and the second console 12 is connected, through a transmission path 16, to a first processor 14 located downstream thereof, and the first processor 14 is connected, through a transmission path 16, to the first console 12 located downstream thereof, so that the two consoles 12 and the one processor 14 are interconnected in

a loop through the transmission paths 16.

[0071]

In this case, for example, one processor may be controlled simultaneously with consoles in two places, that is, a console located backward in the concert site and a console in a stage wing.

[0072]

According to the connection method shown in Fig. 3(b), a first console 12 is connected, through a transmission path 16, to a first processor 14 located downstream thereof, the first processor 14 is connected, through a transmission path 16, to a second processor 14 located downstream thereof, and the second processor 14 is connected, through a transmission path 16, to the first console 12 located downstream thereof, so that the one console 12 and the two processors 14 are connected in a loop through the transmission paths 16.

[0073]

In this case, for example, it is possible to increase the number of channels that can be processed by connecting two processors, and to control the two processors with one console.

[0074]

According to the connection method shown in Fig. 3(c), a first console 12 is connected, through a transmission path 16, to a first processor 14 located downstream thereof, the first processor 14 is connected, through a transmission path 16, to a second console 12 located downstream thereof, the second console 12 is connected, through a transmission path 16, to a second processor 14 located downstream thereof, and the second processor 14 is connected, through a transmission path 16 to the first console 12 located downstream thereof, so that the two consoles 12 and the two processors 14 are interconnected in a loop through the transmission paths 16.

[0075]

In this case, for example, it is possible to increase the number of channels that can be processed by connecting two processors, and to control the two processors from two consoles, one in the back part of the concert site and the other on the stage

wing.

[0076]

As exemplified in Figs. 3(a), 3(b), and 3(c), constituting the mixing system by interconnecting the console 12 and the processor 14 through the transmission paths 16 to include at least one each of the console 12 and the processor 14, in a total number of more than two of the console 12 and the processor 14, makes it possible to transmit (output) signals (digital control signals and digital voice signals) from the upstream console 12 or processor 14 to the downstream console 12 or processor 14 through the transmission paths 16.

[0077]

That is, this mixing system carries out a digital control signal reception process routine, a roll call command transmission process routine, and a roll call command reception process routine, which will be described later, to attach a unit numbers as discrimination information to each of the consoles 12 and the processors 14 constituting the mixing system to discriminate them. Transmitting digital control signals with the unit number attached through the transmission paths 16 makes it possible to control the console 12 or processor 14 corresponding to the unit number.

[0078]

The digital control signal reception process routine, roll call command transmission process routine, and roll call command reception process routine, which will be described later, are carried out with a CPU (not shown) of the processor 14.

[0079]

For example, in case a plural number of processors 14 are connected, the user chooses a unit number attached to an intended processor 14 using an operation member to be controlled on a panel (not shown) of the console 12 to send out a digital control signal, with the unit number attached, from the console 12 through the transmission path 16.

[0080]

In case two consoles are used, by supplying a voice level

control signal of the remote fader from one console to the other console, the other user of the other console comes to know the voice level of the one console.

[0081]

When the console 12 and the processor 14 are connected in a loop as shown in Fig. 3 to provide the function of supplying digital control signals supplied from an upstream-located console 12 or processor 14 to a downstream-located console 12 or processor 14, the digital control signals can be transmitted endlessly through the transmission path 16. This must be prevented.

[0082]

Therefore, the digital control signal is attached with two unit numbers. One is the transmission address unit number indicating the device to be controlled with the digital control signal. The other is the output stop unit number indicating the device for stopping the supply of digital control signal supplied from an upstream device to a downstream device. These two unit numbers are specified respectively to two words constituting the digital control signal.

[0083]

The output stop unit number attached is actually the unit number of the device that outputs the digital control signal first.

[0084]

Incidentally, this mixing system is adapted to permit connection of up to eight devices, and numerals 0 to 7 are to be assigned as unit numbers.

[0085]

It is adapted that, if the numeral 8 is assigned as a transmission address number, all the devices are specified to be transmission addresses.

[0086]

With reference to Fig. 4 or the flowchart of the digital control reception process routine, outline will be described on the digital control signal reception process, or the process the console 12 and the processor 14 carry out when the digital control

signal is supplied from the console 12 or the processor 14 located upstream of the console 12 or the processor 14.

[0087]

First, the console 12 and the processor 14, when the digital control signal is supplied from an upstream console 12 or processor 14, compare the transmission address unit number attached to the supplied digital control signal with the unit number of their own (the console 12 or processor 14 that received the digital control signal). In case the own unit number agrees with the inputted transmission address unit number attached to the digital control signal, the console 12 and the processor 14 carry out the process (steps S302 and S304) on their own.

[0088]

Next, the console 12 and the processor 14 compare the output stop unit number attached to the supplied digital control signal with the unit number of their own (the console 12 or processor 14 that received the digital control signal). In case the output stop unit number attached to the supplied digital control signal does not agree with the unit number of their own, supply the digital control signal to the downstream console 12 or processor 14. In case of agreement, they do not supply the digital control signal to the downstream console 12 or processor 14 (steps S306 and S308).

[0089]

In this way, the digital control signal is prevented from being transmitted endlessly through the transmission paths 16.

[0090]

Depending on the time when digital control signals are inputted, there may be a case in which digital control signals as voice level control signals or digital input level information, produced within the device itself are being transmitted outward, or a case opposite to that. In such a case, the digital control signals inputted or produced later are temporarily stored and transmitted after finishing transmission of the digital control signals.

[0091]

Incidentally, the digital input level information has only

the output stop unit number attached thereto, and no transmission address unit number attached thereto, because of the reason described below.

[0092]

As described before, because the unit number of the device that outputs the digital control signal first is attached as the output stop unit number, the device that has first outputted the digital control signal is known from the output stop unit number.

[0093]

So, in case a plural number of processors 14 are used, the user of the console 12 chooses a unit number of an intended processor 14 using an operation member for choosing a subject to be displayed on a panel (not shown) of the console 12.

[0094]

The console 12 chooses a digital control signal, out of the supplied digital control signals, with its output stop unit number matching the unit number specified by the user, and, according to this digital control signal, displays the level on the level meter 36.

[0095]

Like the downstream supply of digital control signals at the console 12 or processor 14, it may be adapted to transfer voice signals separated from the separating section 30 or voice signals separated from the separating section 40 to the multiplexing section 28 or the multiplexing section 52 and supply them to the downstream processor 14 or console 12.

[0096]

In this case, whether or not the digital control signal is to be supplied downstream is controlled with the output stop unit number contained in the digital control signal. However, it is preferable to determine whether or not the voice signal is to be supplied to the downstream processor 14 or console 12 according to the instruction by the user.

[0097]

For example, it may be adapted that whether or not downstream supply is to be made is instructed by means of an operation member

on a panel (not shown) of the processor 14 or console 12.

[0098]

Or, it may be adapted that the user, by means of the operation member provided on the panel (not shown) of the console 12 or processor 14 and using a digital control signal, gives instruction to other console 12 or processor 14 on whether or not the downstream supply is to be made by other console 12 or processor 14.

[0099]

Next, with reference to the flowchart of roll call command transmission process routine shown in Fig. 5, the roll call command transmission process is described.

[0100]

This roll call command transmission process routine is started up when the console 12 is started up by turning on power of the console 12 chosen as a master or by making roll call transmission operation at the operation panel (not shown) of the console 12 after interconnecting and wiring appropriately, using the transmission path 16, the console 12 and processor 14 that constitute the mixing system. The routine is a process in the console 12 chosen as a master.

[0101]

It is also adapted that the digital control signal reception process routine is at rest when the roll call command transmission process routine is started up in the console 12.

[0102]

When this roll call command transmission process routine is started up, first an output stop unit number of 0 (own unit number) is attached from the console 12 started up as a master, a transmission address unit number of 8 (unit number specifying all the devices) is attached, and a roll call-use unit number of 0 (own unit number) is attached, and the roll call command is transmitted downstream through the transmission path 16 (step S402).

[0103]

The roll call-use unit number is used for the roll call.

[0104]

The roll call command is transmitted as a kind of digital control signal from the multiplexing section 28. In downstream console 12 or processor 14, the roll call command is separated from the digital control command with the separating section 30 or the separating section 40.

[0105]

Here, the downstream console 12 or the processor 14 that receives a roll call command sent from the console 12 started up as a master is only to receive the roll call command and perform a process according to the roll command reception process routine (described later), and transmits the result as a kind of digital control signal to the downstream console 12 or processor 14.

[0106]

Therefore, in case the console 12 and the processor 14 are connected through the transmission path 16 in a loop, the roll call command will return to the console 12 that, as a master, has transmitted the roll call.

[0107]

When the step S402 is over in the process, the process goes to the step S404 to determine if a specified period of time has elapsed from the transmission of the roll command in the step S402. The specified period of time is any predetermined period of time, for example 5 seconds.

[0108]

Here, in case it is determined in the step S404 of the process that the predetermined period of time has elapsed, it is determined that the console 12 and the processor 14 constituting the mixing system are not connected in a loop through the transmission paths 16 as shown in Figs. 3(a), 3(b), and 3(c), an error process (step S406) is carried out to end this roll call command transmission process routine.

[0109]

Actually, that the transmission paths 16 are not connected in a loop is displayed on a screen (not illustrated) of the console 12 before the user.

[0110]

On the other hand, in case it is not determined in the step S404 of the process that the predetermined period of time in the step S402 has elapsed, the console 12 chosen as a master determines if the console itself has received the roll command itself has transmitted (step S408).

[0111]

Here, in case the step S408 determines that the console 12 chosen as a master has not received the roll command itself has transmitted, the process returns to the step S404 to repeat the process.

[0112]

On the other hand, in case the step S408 determines that the console 12 chosen as a master has received the roll command itself has transmitted, the console 12 chosen as a master sets its own unit number of 0 (step S410).

[0113]

When the process of the step S410 is over, the roll call-use unit number of the received roll call is stored (step S412) to end this roll command transmission process routine.

[0114]

The stored unit number shows the number of devices connected in this mixing system. This is used for transmitting a request command described later.

[0115]

Next, with reference to the flowchart of the roll call command reception process routine shown in Fig. 7, a roll call command reception process with the console 12 and processor 14 on the downstream side of a console 12 chosen as a master will be described.

[0116]

This roll call command reception process routine is started when a roll command outputted from upstream console 12 and processor 14 is received through the transmission path 16, and carried out respectively in the console 12 and processor 14 located on the downstream side of the console 12 chosen as a master.

[0117]

In this roll call reception process routine, first the roll call-use unit number of the receive roll call command is increased by 1 and the result is set as the own unit number (of the console 12 or processor 14 implementing this roll call command reception process routine) (step S502).

[0118]

After the process of the step S502 is over, the process goes to the step S504 to transmit downstream through the transmission path 16, a roll command attached with the own unit number set as a unit number in the step S502, to end this roll call command reception process routine.

[0119]

The console 12 as a master that has received the roll command, receives the roll command by the step S408 of the roll call command reception process routine, and carries out a process so that the roll command does not circulate in the loop.

[0120]

Fig. 7 shows a diagram of state transition of the first console 12 (master), the first processor 14, the second console 12 (slave), and the second processor in the roll call command transmission process and roll call command reception process described above for the case the first console 12 is used as a master in the mixing system shown in Fig. 3(c).

[0121]

As seen from the state transition diagram shown in Fig. 7, when the first console 12 or a master, transmits a roll call command, unit numbers are set respectively to the first console 12, the first processor 14, the second console 12, and the first processor 14.

[0122]

Thus, after the roll call command transmission process and the roll call command reception process are over without errors, the numbers of consoles 12 and processors 14 connected in the loop-connected transmission paths 16 can be determined by setting the roll call command data the first console 12, a master, has received as the final unit number.

[0123]

Unit numbers of the consoles 12 and processors 14 are uniquely set, respectively. The console 12 chosen as a master becomes capable of sending digital control signals individually to the consoles 12 and processors 14 to control them.

[0124]

Also each console 12 other than the one chosen as a master and each processor 14 become capable of sending digital control signals to the console 12 chosen as a master, each console 12, and each processor 14.

[0125]

After that, the first console 12 or a master, sends a request command as a kind of digital control signal, with a transmission address unit number attached, requesting a reply for confirming if each device to which a unit number is set is a console 12 or processor 14, individually to each console 12 and each processor 14.

[0126]

The consoles 12 and processors 14 respectively send a reply to the request command as a kind of digital control signal to the console 12 chosen as a mater, other consoles 12, and processors 14.

[0127]

As a result, each device knows what devices are connected in what order to the mixing system. The console 12, based on this, informs the user of the connection state by illustrating the kind and order of the devices connected on a display device (not shown).

[0128]

Incidentally, with the above embodiment, a connection method for constituting a mixing system is shown as an example in which consoles 12 and processors 14 are connected as shown in Figs. 1, 3(a), 3(b), and 3(c). The connection method is a mere example and it is a matter of course that the mixing system may be constituted by connecting any number of consoles 12 and processors 14 in any order in a loop.

[0129]

The above embodiment is also adapted that, as a method of preventing the digital control signal from running endlessly through the transmission paths, the digital control signal, inputted from the transmission path, with its own unit number being the same as the output stop unit number, is not outputted to the downstream console 12 or processor 14. However, the method is not limited to the above but other methods may be used.

[0130]

For example, it may be adapted that the digital control signal, with its own unit number matching a transmission address unit number attached to the digital control signal, is not outputted to the downstream console 12 or processor 14.

[0131]

It may also be adapted that a unit number for countdown is attached to the digital control signal. And the device that first transmits the digital control signal sets the number of devices connected in the mixing system as the countdown unit number when transmitting the digital control signal downstream.

[0132]

Each device receiving the digital control signal, subtracts 1 from the value of the countdown unit number, and transmits it to a downstream device.

[0133]

As each device repeats the above process and the value of the countdown unit number attached to the digital control signal becomes 1, the device stops sending the digital control signal to downstream device.

[0134]

The above embodiment is also adapted to detect and display the input level of the voice signal inputted in the voice processing device on the level meter 36 provided outside. However, the level meter 36 may be installed within the voice control device 12.

[0135]

Further, the level meter 36 may be of any type as long as voice levels are displayed. The type is thought to include meter

type, bar chart type, etc.

[0136]

While the above embodiment is adapted to detect and display the input level of the voice signal, it may also be adapted that occurrence of voice signal input is detected or detection is made when a specific voice level is exceeded, to display the results of detection by lighting up or not lighting up light of a display device.

[0137]

Also, while the voice signal processing section 48 and the input level detection section 46 are embodied with separate DSPs, they may be embodied with a common, single DSP.

[0138]

While the above embodiment is also adapted that only the voice signal inputted to the voice processing device 14 is handled as the voice signal to be detected for its signal level, it may also be adapted that, in addition to the voice signal inputted to the voice processing device 14, also the voice signal in the process of mixing or the voice signal outputted to the D-A converter 50 after mixing process may be detected for its signal level to be displayed.

[0139]

In that case, it may be adapted to detect all the voice signal levels and display the detected results, or to display only the voice signal levels the user optionally chooses. Also in that case, it is possible to detect all the voice signal levels, send all the detected results through the transmission path 18 to the voice control device 12, and selectively display only required results detected.

[0140]

Or, it may also be adapted to send information as a kind of digital control signal for specifying a voice signal the user wants to display its level coming from the voice control device 12 through the transmission path 16 to the voice processing device 14, so that the voice processing device 14 detects the level of the specified voice signal according to the information, and sends

the detected result through the transmission path 18 to the voice control device 12 and display required detected result.

[0141]

In that case too, it is possible to monitor the state of voice signal during or after the mixing process.

[0142]

In this way, because not all the voice signal levels have to be detected, a minimum extent of constitution suffices for the detection.

[0143]

The above embodiment is also adapted that only the voice signal outputted to the D-A converter 50 may be listened to on trial through the transmission path 18 and the voice control device 12. However, it may also be adapted that, in addition to the voice signal outputted to the D-A converter 50, the voice signal inputted to the voice processing device 14 or the voice signal in the process of being processed may be listened to on trial through the transmission path 18 and the voice control device 12.

[0144]

Alternatively, it may be adapted to transmit information, as a kind of control signal for specifying the voice signal the user wants to listen to on trial from the voice control device 12 through the transmission path 16 to the voice processing device 14. The voice processing device 14, according to the information chooses the voice signal inputted to the voice processing device 14 or in the process of being processed, and transmits it to the voice control device 12.

[0145]

While the above embodiment is described as using the transmission path 16 using the cable according to existing format, AES-EBU specification, the transmission path may be of any form as long as it can multiplex the voice signal and the control signal.

[0146]

For example, it may be an optical cable or the like of SPDIF specification. Further, the transmission path 16 may be embodied

with radio waves or light connected in a loop through wireless communication.

[0147]

Further, while the voice processing device 14 in the above embodiment is the one that mix-processes analog voice signals, it may be one that mix-processes digital voice signals.

[0148]

[Effects of the Invention]

Because this invention is constituted as described above, when at least a total of three voice control devices and voice processing devices including at least one each of them are interconnected and used as a mixing system, an excellent effect is provided that there is no need of providing a separate unit for mixing or branching the transmission paths interconnecting the devices, without inviting problems of complicated constitution or increased costs.

[Brief Description of Drawings]

Fig. 1 is a block diagram as a hardware constitution of a mixing system according to the present invention.

Fig. 2 is a data division format according to AES-EBU specification.

Fig. 3 is an explanatory drawing of an example of connection method to constitute a mixing system by interconnecting through transmission paths a total number of more than two, including at least one each of a console and processor. Fig. 3(a) shows an example of interconnecting two consoles and one processor through transmission paths. Fig. 3(b) shows an example of interconnecting one console and two processors through transmission paths. Fig. 3(c) shows an example of interconnecting two consoles and two processors through transmission paths.

Fig. 4 is a flowchart of a digital control reception process routine.

Fig. 5 is a flowchart of a roll call command transmission process routine.

Fig. 6 is a flowchart of a roll call command reception process routine.

Fig. 7 is a state transition diagram of the first console (master), the first processor, the second console (slave), and the second processor, in a roll call command transmission process and roll call command reception process when the first console is used as the master in the mixing system shown in Fig. 3(c).

[Description of Reference Numerals and Symbols]

10: mixing system
12: voice control section (Console)
14: voice processing section (Processor)
16, 18: transmission paths
20: remote fader
20-1 to 20-4: fader operation member
22, 26, 44: analog-to-digital (A-D) converter
24, 42-1 to 42-4: MIC (microphone)
28, 52: multiplexing sections
30, 40: separating sections
32, 50: D-A converter
34: headphone
36: level meter
38: memory card reading section
46: input level detecting section
48: voice signal processing section
54: speaker
54L: speaker for left channel
54R: speaker for right channel

FIG. 2

Data division format diagram

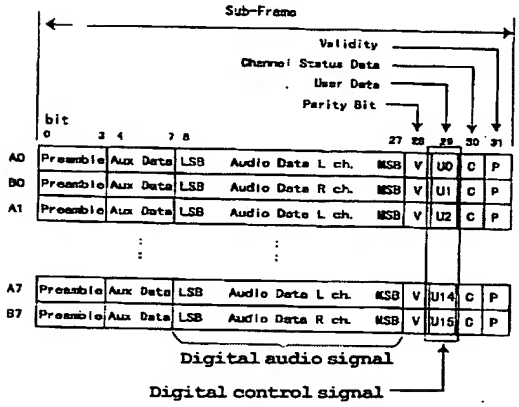
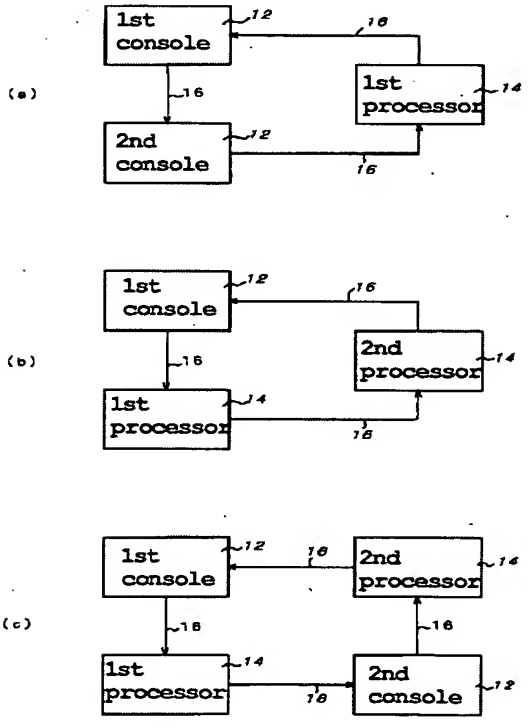


FIG. 3



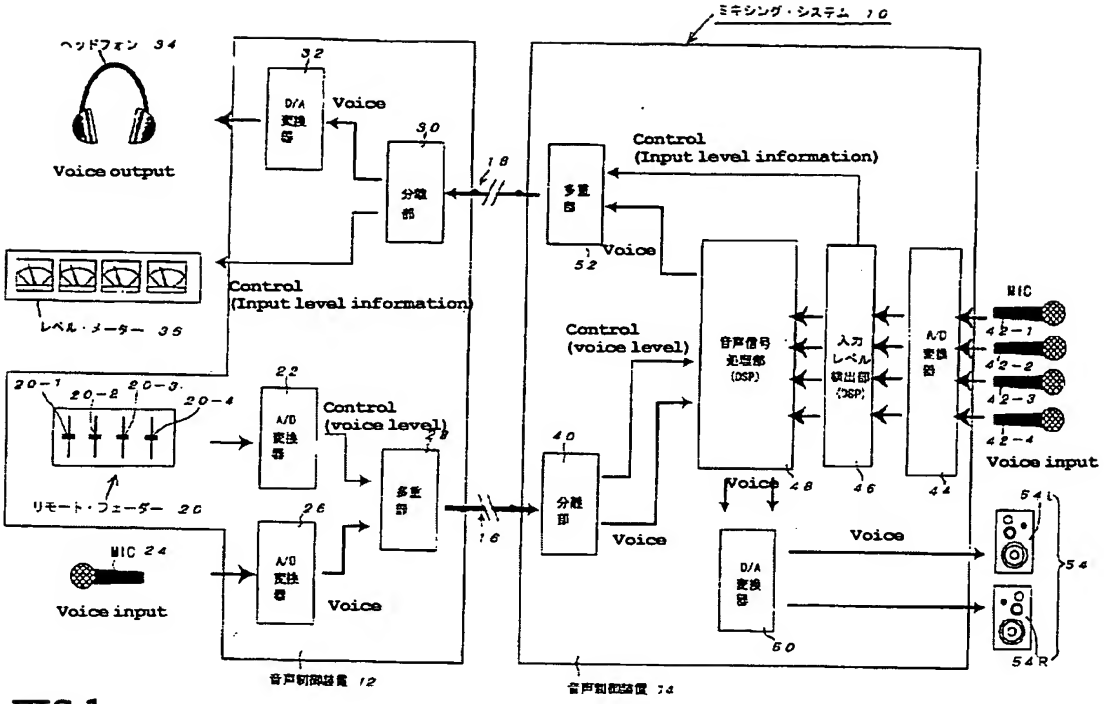


FIG.1

Fig. 1

10: Mixing system

12: Voice control device

14: Voice processing device

20: Remote fader

22, 26, 44: A-D converter

24: MIC

28, 52: Multiplexing sections

30, 40: Separating section

32, 50: D-A converter

34: Headphone

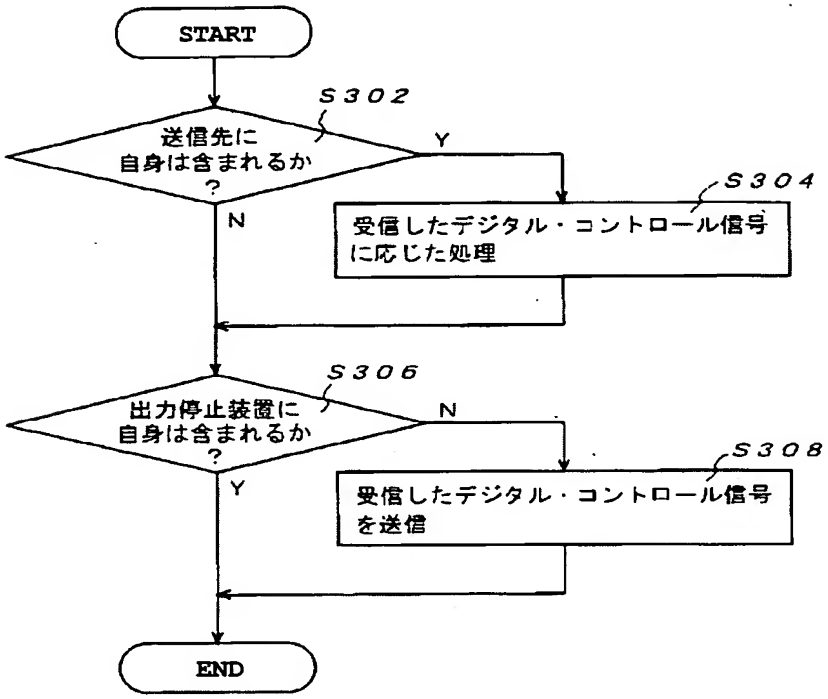
36: Level meter

46: Input level detecting section (DSP)

48: Voice signal processing section (DSP)

FIG. 4

Digital control signal reception process routine



S302: Is itself one of transmission addresses?
S304: Process according to received digital control signal
S306: Is itself one of output stop devices?
S308: Transmit received digital control signal

FIG. 6

Roll call command reception process routine

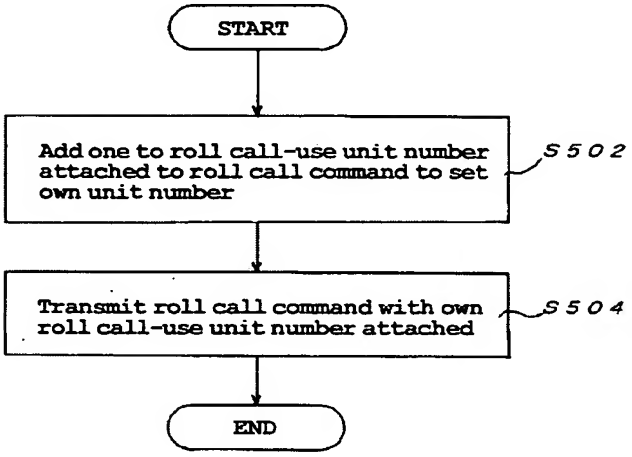


FIG. 5

Roll call command transmission process routin

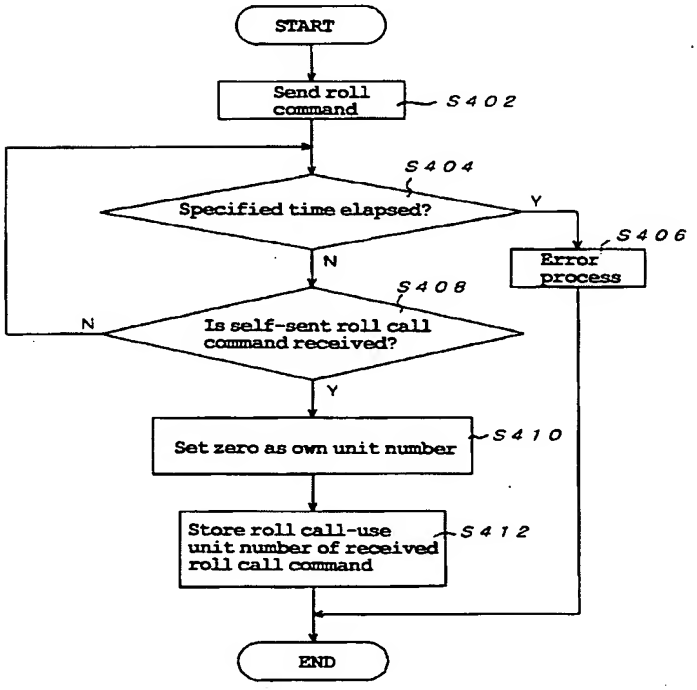


Fig. 7

1st console (master)	1st processor	2nd console (slave)	2nd processor
Receive roll call command. Send roll call command with roll call unit number attached.			
	Receive roll call command with roll call unit number attached. Unit number 1. Send roll call command with roll call unit number attached.		
		Receive roll call command with roll call unit number attached. Unit number 2. Send roll call command with roll call unit number attached.	
			Receive roll call command with roll call unit number attached. Unit number 3. Send roll call command with roll call unit number attached.
Receive roll call command with roll call unit number attached. Cancel. Unit number 0. Store roll call unit number.			